BYRON SHIRE COUNCIL

2024 Annual Water Contamination Report

Myocum Landfill

Byron Shire Council

Annual Water Contamination Report 2024

Myocum Landfill, Byron Shire Council

Document Control

Revision	Status	Author	Reviewed	Authorised	Date
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Table of Contents

Tables and Figures

Appendices

1. Introduction

Byron Shire Council (BSC) operates the Myocum Landfill, located on Lot 1 DP1052900, 115 Manse Road, Myocum, NSW, 2481, under Environmental Protection Licence (EPL) No. 6057 dated 17th of June 2024 for Waste Disposal activities. A second licence (EPL13127 – revised on 15th of April 2024) is active for the site under the Byron Resource Recovery Centre for additional activities not covered under EPL6057. The site is located approximately 4.5 km south of Mullumbimby and 12 km northwest of Byron Bay. The site location is shown in the local context in Figure 1-1. The neighbouring property to the west is also under Byron Shire Council ownership as the Myocum Quarry located on Lot 1 DP591441 under EPL12600.

In accordance with the Environmental Protection Licence 6057, BSC implements an environmental monitoring program, as presented in the Landfill Environmental Management Plan (Maunsell 2008), and incorporates:

- Regional and alluvial groundwater monitoring;
- Surface water monitoring;
- Leachate monitoring;
- Landfill gas monitoring; and
- Noise monitoring.

In 2003 the commencement of the landfill monitoring program coincided with the reopening of the landfill following an extended period of closure.

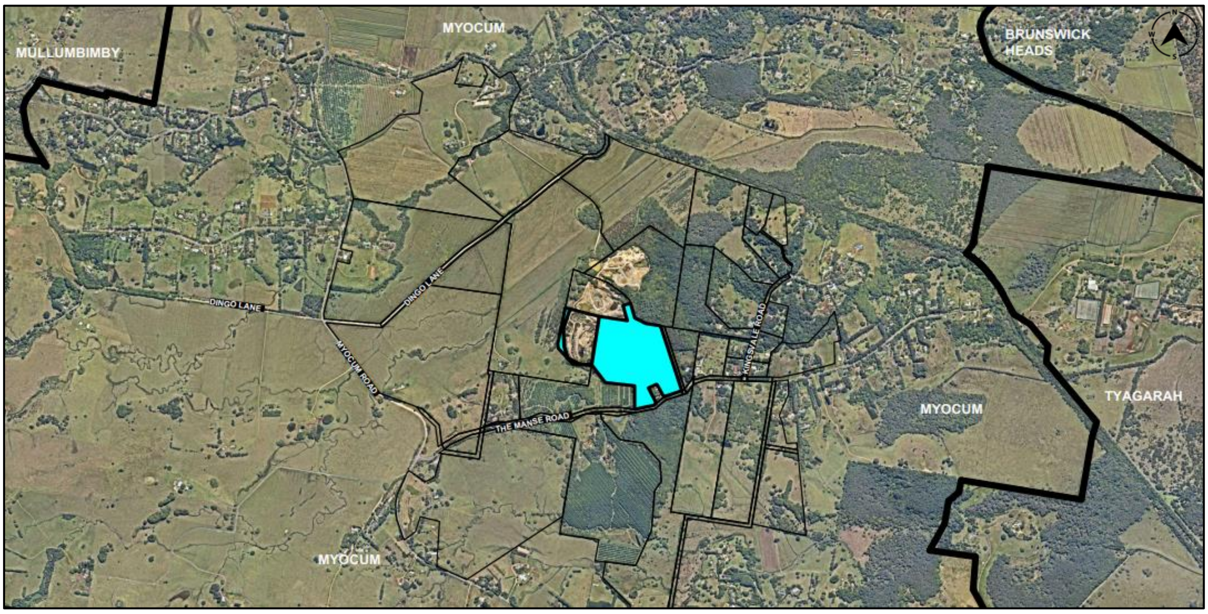

Figure 1-1: Myocum Landfill site in the locality (Image Source: NearMap 3 October 2021)

1.1 Project Aims and Objectives

As part of Council's annual reporting requirements to the NSW Environment Protection Authority (EPA), submission of an Annual Water Contamination Report consisting of a summary assessment of water quality monitoring for Myocum Landfill during the previous 12-month period is required. This report aims to present the monitoring data for the period ranging from September 2023 to August 2024, in accordance with condition E1 of EPL6057 for submission by the 1st of November 2024. Licence conditions relevant to this report are outlined in Section 1.2.

Key project objectives are to:

- Report all monitoring actions and results between September 2023 – August 2024;
- Compare monitoring results to past collected data and stated water quality trigger values;
- Evaluate any human and/or environmental impacts resulting from the operation of the landfill; and
- Recommend mitigation measures for any identified human and/or environmental impacts.

1.2 Licence Conditions

Under the NSW EPA EPL6057, BSC is required to submit an Annual Water Contamination Report. As a minimum, this report must include the following:

Alluvial Groundwater:

(a) A tabular and graphical representation of the results of all alluvial groundwater monitoring undertaken for Monitoring Points 4 – 5 over the previous 12-month period in accordance with condition M2.

(b) Comparison of the results with the most relevant ANZECC/NWQMS triggers (see Table 1-1) and with results from previous annual reporting periods, including as assessment of any changes and trends over time.

(c) Evaluation of the nature and level of (and changes to) any human health and environmental risks to alluvial groundwaters and any other environmentally sensitive receivers.

(d) An assessment of whether the current detection monitoring program should be augmented to also sample for chemicals of concern (i.e., in addition to the leachate indicator analytes in M2).

(e) Any further mitigation measures proposed to be implemented for the subsequent 12-month period to further reduce contamination levels and risks to human health and the environment.

Regional Groundwater:

(a) A tabular and graphical representation of the results of all regional groundwater monitoring undertaken for monitoring Points 1-3 and 23-24 over the previous 12-month period in accordance with condition M2.

(b) Comparison of the results with the contamination trigger levels (see Table 1-1) and with results from previous annual reporting periods, including an assessment of any changes and trends over time.

(c) Evaluation of the nature and level of (and changes to) any human health and environmental risks to regional groundwaters and any other environmentally sensitive receivers.

(d) An assessment of whether the current monitoring regime should be augmented to also sample for chemicals of concern (i.e., in addition to the leachate indicator analytes in M2).

(e) Any further mitigation measures proposed to be implemented for the subsequent 12-month period to further reduce contamination levels and risks to human health and the environment.

Surface Water:

(a) A tabular and graphical representation of the results of all surface water monitoring undertaken for monitoring Points 6, 8 and 33 over the previous 12-month period in accordance with condition M2.

(b) Comparison of the results with the contamination trigger levels (see Table 1-1) and with results from previous annual reporting periods, including an assessment of any changes and trends over time.

(c) Evaluation of the nature and level of (and changes to) any human health and environmental risks to surface waters and any other environmentally sensitive receivers.

(d) An assessment of whether the current monitoring regime should be augmented to also sample for chemicals of concern (i.e., in addition to the leachate indicator analytes in M2).

(e) Any further mitigation measures proposed to be implemented for the subsequent 12-month period to further reduce contamination levels and risks to human health and the environment.

Table 1-1: Water Quality Triggers

	Regional Groundwater (NSW EPA, 2011)	Alluvial Groundwater (ANZECC, 2006)	Surface Water (NSW EPA, 2011)
pH	2.9 – 6.7	6.5 – 8.5	6.5 – 9.0
Conductivity (µS/cm)	3,800	2,200	610
Calcium (mg/L)	2.0	-	20.7
Sodium (mg/L)	65	-	70
Potassium (mg/L)	1.0	-	11.8
Alkalinity (mg/L)	13.5	-	116
Chloride (mg/L)	118	-	150
Ammonia (mg/L)	1.74	1.43	0.36
Total Organic Carbon (mg/L)	13	-	20.3
Nitrate (mg/L)	1.87	-	3.4
Manganese (mg/L)	0.63	2.5	2.5
Sulphate (mg/L)	26.0	-	100
Magnesium (mg/L)	5.0	-	50
Iron (mg/L)	0.08	1	1
Dissolved Oxygen (mg/L)	-	-	> 6.0

2. Relevant Background Information

The climate of coastal northern New South Wales is sub-tropical, characterised by warm and wet summers with generally dry and mild winters. A summary of the monthly rainfall records from Myocum Landfill between September 2023 and August 2024 is provided in Table 2-1, rainfall totals recorded generally differ from the historical median over 22 years. Figure 2-1 presents monthly total and highest daily rainfall event, compared to the historical median.

Over the past 12 months reporting period, there have been eight above-average rainfall periods in November 2023, January to May, July and August 2024. The remainder of the year had below average rainfall with September and December 2023 and June 2024 experiencing very low rainfall (4.8, 24.6 and 15.4 mm respectively).

Table 2-1: Summary of monthly rainfall records at Myocum Landfill

	2023				2024							
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Reporting Period (mm)	4.8	71.8	230.8	24.6	226.4	193.2	163.2	210.4	255.2	15.4	133.8	169.6
Median Rainfall* (mm)	39.8	73.8	61.2	108.6	144.2	176.2	144.2	127.8	109.8	113.4	71.2	41.3

Note: * Data derived from BOM weather station 58216 between 2002 - 2024

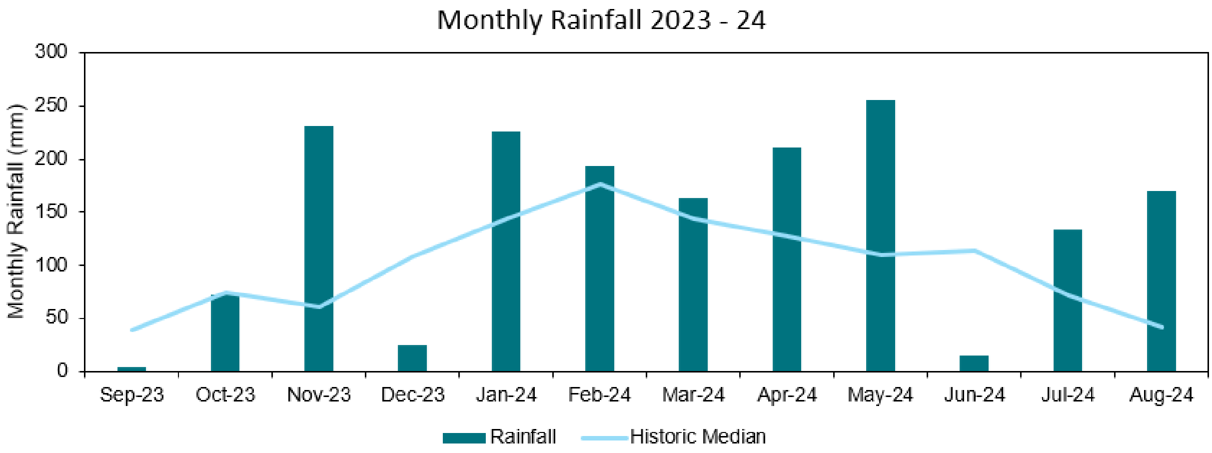

Figure 2-1: Monthly rainfall at Myocum Landfill within reporting period and Historical Median - Data derived from BOM station 58216 (2002-2024)

2.1 Landfill Description

In 2003, subject to the requirements of the EPL6057 and following landfill remediation works associated with leachate management, BSC recommenced landfilling activities at Myocum Landfill to accept general solid putrescible waste to a maximum limit of 20,000t per annum plus other wastes specified in the EPL6057. In 2006, the NSW EPA approved the expansion of landfill operations to the south, termed 'Southern Expansion'. There are two main landfilling areas within the Myocum Landfill:

- Northern Landfill (Original), accepting waste between 1976-2007 (suspended 2000-03 due to leachate remediation works); and
- Southern Landfill, accepting waste between 2007 to 2014.

The Myocum Landfill currently operates as a transfer station (EPL13127), accepting waste from the entire Byron Shire area for transport to a Queensland licenced waste facility.

The layout of the Myocum Landfill is shown in Figure 2-2, showing:

- The original northern landfill area;
- Southern expansion area;
- Landfill infrastructure;
- Resource Recovery infrastructure;
- Site sheds and offices; and
- Neighbouring land uses and receiving environments.

Figure 2-2: Layout of Myocum Landfill (Image Source: NearMap 3 October 2021)

2.2 Topography, Drainage and Geology

The underlying geology consists of interbedded chert quartzite and argillite-claystone deposited during the Palaeozoic Era and forms part of the wider Claremont-Moreton Basin. The overlying soils present within the landfill area are a mixture of yellow and red podzolic, with yellow podzolic in dominance generally comprised of fine-grained clay sediments associated with the residual weathered bedrock and/or localised alluvium deposits (Maunsell, 2002).

The topography of the site is characterised by undulating slopes with a generally westerly aspect; there has been a substantial modification of ground surface due to the landfill operations and quarrying on the neighbouring allotment. Drainage from upslope of the landfill facility is captured and directed to the north into an unnamed drainage line that meets Pipeclay Creek which forms part of the greater Brunswick River catchment.

The landfill site can be delineated into sub-catchments with a variety of surface types and areas. There are three main catchments within the Myocum Landfill, each further made up of minor sub-catchments:

1. The northern catchment drains generally to the north with surface flow being directed to the sediment basin and ephemeral creek in the far north of the site (Northern Sediment Dam);
2. The southern catchment drains to the Southern Sediment Dam and an ephemeral creek running along the southern boundary of the site; and
3. The western catchment is predominantly vegetated on relatively undisturbed (not landfill) soil areas with an existing management and conveyance system that is adequate.

2.3 Hydrogeology

Two groundwater systems have been located within and surrounding the Myocum Landfill based on previous site investigations:

1. Regional Aquifer within fractured bedrock; and
2. The perched alluvial aquifer within the alluvial soils along creek valley.

The groundwater level within the Regional Aquifer has historically ranged between RL 10 to 32m with movement generally in a northerly direction following the topography. There is a local depression within the Regional Aquifer within the Quarry area, due to the extraction of material within the quarry. Recharge of the Regional Aquifer is most likely to occur via rainfall infiltration on the surrounding hillsides.

The perched alluvial aquifer has been recorded between RL 10 to 16m and is adjacent to the northern landfill face. Groundwater depth generally mimics topography whereby standing water levels within the aquifer become shallower with a lowering in topography onto the surrounding floodplain, resulting in a northerly flow of groundwater. Recharge of the alluvial aquifer is most likely to occur via direct surface water infiltrating along the creek valley.

2.4 Monitoring Regime

In accordance with EPL 6057, BSC monitor water quality parameters in both the Regional and Alluvial Aquifers along with surface waters to the north and south of the landfill. Figure 2-3 displays the location of monitoring sites within and adjoining Myocum Landfill. Table 2-2 details relevant EPA and BSC Monitoring Point identification, general location and specific ground/surface water systems monitored. Water quality samples from the regional and alluvial aquifer monitoring sites surface water monitoring sites were obtained on the:

- 16 November 2023;
- 14 February 2024;
- 15 May 2024; and
- 31 July 2024.

Table 2-2: Summary of Water Quality Monitoring Sites at Myocum Landfill relevant to Condition M2.3

Monitoring Aspect and min. frequency	BSC Monitoring Site	EPA Monitoring Point	General Location
Groundwater – Regional Aquifer Required every six months.	MW01	EPA 01	Northern edge of landfill (within Northern Sediment Dam)
	MW02	EPA 02	Southern edge of landfill (upgradient from Southern Expansion)
	MW03	EPA 03	Western edge of landfill, within Myocum Quarry
	MW06	EPA 23	Southern edge of landfill (adjacent Southern Expansion)
	MW07	EPA 24	Within customer interface area to the west of landfill

Monitoring Aspect and min. frequency	BSC Monitoring Site	EPA Monitoring Point	General Location
Groundwater – Alluvial Aquifer Required every six months.	MW04	EPA 04	Northern edge of landfill, adjacent Northern Sediment Dam
	MW05	EPA 05	Northern edge of landfill, downstream from Northern Sediment Dam
Surface Water Required every six months at a time when flow occurs.	SW1	EPA 33	Simpsons Creek tributary (accessed from Myocum Rd, 1km to the west of landfill site)
	SDP1	EPA 06	Surface Water Discharge Point 1 for the Northern Sediment Dam outlet.
	SDP2	EPA 08	Surface Water Discharge Point 2 for the Southern Sediment Dam outlet.

In addition to the monitoring sites listed in Table 2-2, Condition M2.5 of the EPL 6057 requires that on each occasion liquid is removed from the leak detection drain sump (LDS – Point 32) must be tested, which has been done by Council accordingly. Monitoring has been undertaken at LDS Point 32 for the past five annual reporting periods, with monitoring occurring concurrently with the quarterly water quality monitoring regime.

Figure 2-3: Myocum Landfill Monitoring Points (Image Source: NearMap 3 October 2021)

Water samples were taken by Tweed Laboratory Centre in accordance with AS/NZS 5667:1998 *Standards on the Sampling of Waters, Waste Waters, Sediments and Sludges*. Samples were transported on ice under chain of custody to the Tweed Laboratory Centre for analysis on the parameters listed in Table 2-3 in accordance with AS ISO 7025:2018 – *General requirements for the competence of testing and calibration laboratories*. Tweed Laboratory Centre is NATA accredited for Accreditation No: 12754 (Chemical Testing – public testing service), and Accreditation No: 13538 (Biological Testing – public testing service).

Table 2-3: List of parameters at each EPA Monitoring Point

EPA Monitoring Points	List of Parameters		
EPA 1-5, 23 & 24 Regional and Alluvial Groundwater	pH Temperature Electrical Conductivity Standing Water Level Calcium Sodium	Magnesium Alkalinity Sulphate Chloride Potassium Manganese	Ammonia (as N) Nitrate (as N) Total Organic Carbon Iron
EPA 6, 8 & 33 Surface Water	pH Temperature Electrical Conductivity Calcium Sodium Total Suspended Solids	Magnesium Alkalinity Sulphate Chloride Potassium Dissolved Oxygen	Manganese Ammonia (as N) Nitrate (as N) Total Organic Carbon Iron

3. Monitoring Results and Discussion

3.1 Groundwater Levels

For this report, the network of monitoring bores at the landfill for both the Alluvial and Regional aquifers have been categorised as either upslope or downslope to better investigate the potential contamination of groundwater resulting from the presence and operation of the landfill. Based on the range of relative groundwater levels (RLs), the location of the landfill and surrounding topography, each monitoring bore can be classified as either being upslope or downslope from the landfill, as shown in Table 3-1. Groundwater levels for the current monitoring period are shown in Table 3-1.

Table 3-1: Monitored Groundwater Levels

Bore No.		EPA No.	Bore Location	Monitored Groundwater Levels (RL)			
				Nov 23	Feb 24	May 24	Jul 24
Regional Aquifer	MW01	EPA 01	**Downslope** of Northern Landfill	4.1	3.4	2.5	4.2
	MW02	EPA 02	**Upslope** of Southern Landfill	12.3	10.1	1.7	6.3
	MW03	EPA 03	Base of Myocum Quarry, **Downslope**	0.8	0.5	0.8	0.6
	MW06	EPA 23	**Upslope** of Southern Landfill	14.7	*	3.5	8.7
	MW07	EPA 24	West of Landfill, **Downslope**	*	23.1	21	23.5
Alluvial Aquifer	MW04	EPA 04	20m **Downslope** of leachate inception trench	2.6	2.4	1.7	3.5
	MW05	EPA 05	70m **Downslope** of Northern Landfill face	3.8	3.9	3.1	5.3

Note: * Sampling not completed

Groundwater levels for both alluvial and regional bores as presented in Figures 3-1 and 3-2, show that decreases to the groundwater level over the entire monitoring period were consistent with the decreased rainfall during the previous months. It is also noted that EPA 24 and 23 had insufficient data during the November 2023, February 2024 monitoring events respectively and as such, no groundwater level was recorded.

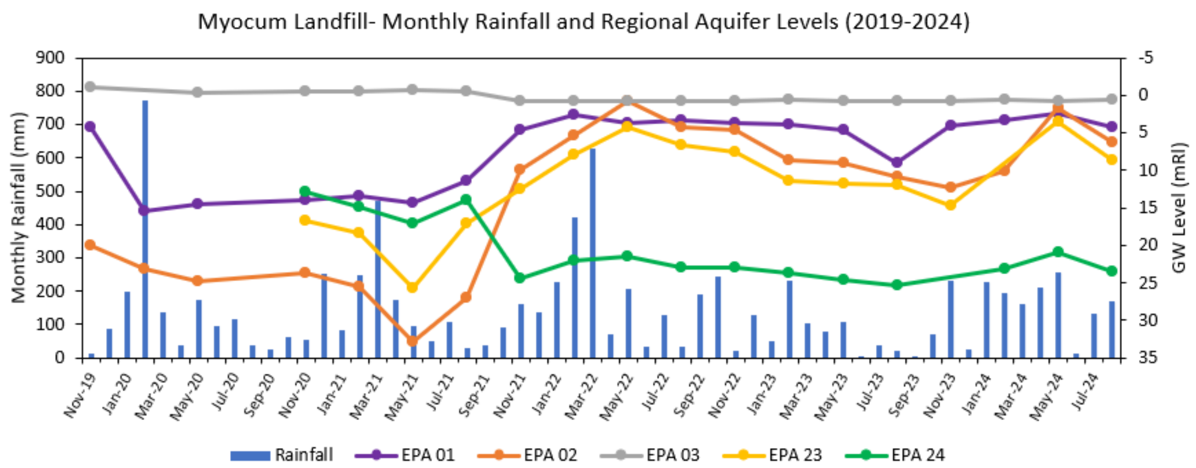

Figure 3-1: Regional Groundwater Levels and Monthly Rainfall (2019-2024)

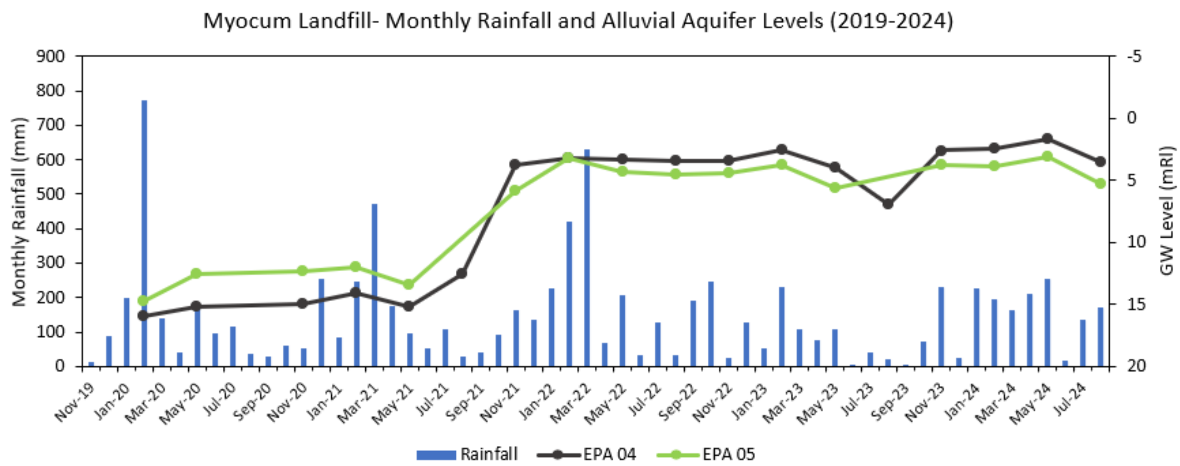

Figure 3-2: Alluvial Groundwater Levels and Monthly Rainfall (2019-2024)

The groundwater levels provided in the graphs above (Figure 3-2) and in Table 3-1 are generally consistent with previous results and seasonal fluctuations and indicate that the surfaces of the regional and alluvial aquifers are representative of the pre-development drainage configuration of the site and fluctuate with rainfall. These trends are presented in Figures 3-1 and 3-2.

Table 3-2 presents accumulated rainfall data over a 1 - 8 week period leading up to each sampling date. Rainfall conditions prior to ground and surface water sampling were variable across the four sampling events.

Table 3-2: Rainfall preceding each Sampling Event

Sample date	Preceding cumulative rainfall (mm)					
	1 week	2 weeks	3 weeks	4 weeks	6 weeks	8 weeks
16-Nov-23	11.2	163.4	227	230.7	235.2	235.2
14-Feb-24	99.4	99.8	117.2	136.2	321.4	347.6
15-May-24	104	174.6	246.2	305.2	385.2	451.6
31-Jul-24	9.2	9.2	9.2	9.4	44.2	221.6

This assessment of cumulative rainfall shows that a significant amount of rainfall occurred leading up to the November 2023 to May 2024 monitoring events.

3.2 Water Quality

For each of the specified water management units (regional groundwater, alluvial groundwater and surface waters), a comparison of the collected data with the *stated water quality triggers* (as per Table 1-1) are required, along with:

- An assessment of any spatial or temporal change in water quality;
- An evaluation (if any) of the nature and level (and changes to) of human health and environmental risks to water management units and other environmentally sensitive receivers;
- An assessment of whether the current monitoring program is adequate in detecting a full suite of possible leachate contaminants; and
- Any mitigation measures are recommended to be implemented for the next 12 months to reduce contamination levels and risks to human health.

Table 3-3 outlines EPA monitoring sites and their applicable water management unit in which they are designed to monitor. Tabulated results of the 2023/24 ground and surface water monitoring program assessed against the *stated water quality triggers* (as per Table 1-1) are presented in Table 3-4. Appendix A presents graphs for groundwater and surface water quality from all EPA monitoring points from December 2003 through to mid-2024.

Table 3-3: Reference Site Monitoring Locations

Water Management Unit	Monitoring Site
Regional groundwater	EPA Points 1, 2, 3, 23 and 24
Alluvial groundwater	EPA Points 4 and 5
Surface water	EPA Points 6, 8 and 33

Table 3-4: Tabulated Summary of Regional, Alluvial and Surface Water Monitoring Results between November 2023 and August 2024. Shaded cells indicate exceedances against defined trigger levels

BSC Point	EPA Point	Date	pH	Temperature °c	Conductivity µS/cm	Alkalinity mg/L	Sulphate mg/L	Chloride mg/L	Calcium mg/L	Magnesium mg/L	Sodium mg/L	Potassium mg/L	Iron mg/L	Manganese (Soluble) mg/L	Ammonia as N mg/L	Nitrate as N mg/L	Total Organic Carbon mg/L	DO ug/L	TSS ug/L
Regional Aquifer WQ Trigger			**2.9-6.7**	**No Trigger**	**3800**	**13.5**	**26.0**	**118**	**2.0**	**5.0**	**65**	**1.0**	**0.08**	**0.63**	**1.74**	**1.87**	**13**	**No Trigger**	
MW01	EPA01	16-Nov-23	6	20.8	330	78	31	30	22	3.8	15	7.2	20.3	1.2	2.86	<0.02	13		
MW01	EPA01	14-Feb-24	6.1	23.9	312	77	27	24	20	3.5	15	7.9	17.3	1.09	2.53	0.14	13		
MW01	EPA01	15-May-24	5.9	20.8	248	50	27	19	18	3.3	15	7.3	16.3	1	1.91	0.09	12		
MW01	EPA01	31-Jul-24	6.1	18.5	306	105	18	24	21	3.6	14	6.7	29	1.23	2.66	1.6	16		
MW02	EPA02	16-Nov-23	4.3	22.7	165	<1	13	26	2.1	4	15	1.2	0.48	0.067	0.53	3.16	1.7		
MW02	EPA02	14-Feb-24	4.1	22.7	161	<1	13	27	0.9	4.1	15	0.8	0.21	0.043	<0.02	1.87	1		
MW02	EPA02	15-May-24	4.2	23	155	<1	13	26	1.1	4	15	0.9	0.16	0.056	<0.02	1.78	1.2		
MW02	EPA02	31-Jul-24	4.4	22	152	<1	12	26	0.9	3.8	15	0.8	0.13	0.037	0.04	0.06	1.3		
MW03	EPA03	16-Nov-23	5.4	21.7	494	17	13	130	11	9.8	58	1.5	0.97	1.68	0.02	0.03	0.9		
MW03	EPA03	14-Feb-24	5.4	24.6	492	14	13	130	11	10	62	1.7	0.37	0.447	<0.02	<0.02	0.5		
MW03	EPA03	15-May-24	5.4	20.8	516	25	12	130	11	10	62	1.6	0.35	6.74	<0.02	<0.02	<0.5		
MW03	EPA03	31-Jul-24	5.5	16.7	520	27	12	140	11	10	59	1.6	0.68	6.92	<0.02	0.02	0.5		
MW06	EPA23	16-Nov-23	4	21.7	268	<1	15	59	0.5	3.9	32	0.6	20.6	1.48	<0.02	0.58	1.3		
MW06	EPA23	14-Feb-24	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
MW06	EPA23	15-May-24	4.1	21.7	268	<1	16	60	0.6	3.7	35	0.6	0.17	0.441	<0.02	0.64	1.2		
MW06	EPA23	31-Jul-24	4.2	20.2	263	<1	16	59	0.7	3.6	33	0.7	0.27	0.359	0.03	0.62	1		
MW07	EPA24	16-Nov-23	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
MW07	EPA24	14-Feb-24	5.7	24.1	326	37	31	16	34	5.5	10	11	5.98	0.017	<0.02	14.7	7.2		
MW07	EPA24	15-May-24	5.6	23.3	276	31	16	23	24	4.5	12	8.2	5.05	0.662	<0.02	12.8	5.9		
MW07	EPA24	31-Jul-24	5.2	22.3	222	15	12	16	10	3.5	15	5.5	4.79	5.65	0.02	7.01	2.4		
Alluvial Aquifer WQ Triggers			**6.5-8.5**	**No Trigger**	**2200**	**No Trigger**							**1**	**2.5**	**1.43**	**No Trigger**			
MW04	EPA04	16-Nov-23	5.3	20.8	234	18	27	32	8.4	2.3	17	8.9	1.04	0.432	3.3	0.98	6		
MW04	EPA04	14-Feb-24	5.8	22.9	189	35	19	22	13	2.4	13	9.1	0.65	0.358	0.05	0.66	7.5		
MW04	EPA04	15-May-24	5.5	22	234	35	18	33	15	2.8	18	8.1	0.41	0.536	0.06	0.12	6		
MW04	EPA04	31-Jul-24	6	19.3	217	40	25	22	17	2.9	12	8.3	0.79	0.539	0.07	0.02	5.5		
MW05	EPA05	16-Nov-23	6	21.1	208	43	19	23	19	2.9	12	8	1.68	0.592	0.14	0.06	8.9		
MW05	EPA05	14-Feb-24	6.1	24.6	191	54	13	14	18	2.4	11	7.7	1.42	0.219	0.11	<0.02	8.9		
MW05	EPA05	15-May-24	6	21.3	210	70	11	14	22	2.9	9.6	7.1	3.57	0.336	0.28	<0.02	7.3		
MW05	EPA05	31-Jul-24	6	18.2	219	46	24	22	17	2.7	11	8.3	5.34	0.535	0.58	0.03	6.5		
Surface Water WQ Triggers			**6.5-9.0**	**No Trigger**	**610**	**116**	**100**	**150**	**20.7**	**50**	**70**	**11.8**	**1**	**2.5**	**0.36**	**3.4**	**20.3**	**>6.0**	**No Trigger**
SDP1	EPA06	16-Nov-23	6.7	24.7	248	64	16	24	24	3.4	11	10	1.38	0.271	0.02	<0.02	11	3.1	9
SDP1	EPA06	14-Feb-24	7.5	25.6	211	74	14	49	25	3	9.7	7.3	0.92	0.01	<0.02	<0.02	11	6.8	25
SDP1	EPA06	15-May-24	7.1	19.3	221	79	12	12	25	2.9	8.2	6.3	0.58	0.023	0.24	0.22	7.6	8.2	13
SDP1	EPA06	31-Jul-24	8.4	14.1	245	69	19	23	27	3.2	11	7.1	1.78	0.013	<0.02	0.06	10	12	37
SDP2	EPA08	16-Nov-23	9	29.8	562	103	39	79	38	8	42	26	0.4	0.018	0.02	2.07	18	14	10
SDP2	EPA08	14-Feb-24	9.1	33.6	514	130	22	71	38	8.3	38	29	0.21	0.01	0.02	<0.02	23	14	15
SDP2	EPA08	15-May-24	8.7	24.2	546	168	9.4	53	44	10	35	31	0.59	0.016	<0.02	2.22	19	15	21
SDP2	EPA08	31-Jul-24	8.1	16	699	175	21	92	51	11	42	43	0.32	0.023	0.05	3.22	19	9.6	4
SW01	EPA33	16-Nov-23	6.3	22.4	379	57	5.9	74	12	11	38	2.4	2.75	1.59	0.08	<0.02	14	1.6	14
SW01	EPA33	14-Feb-24	6.4	23	238	59	2.5	36	11	7.3	24	1.4	4.96	1.25	0.03	<0.02	13	2	8
SW01	EPA33	15-May-24	6.6	18.4	254	61	2.4	36	11	7.6	26	1.6	2.56	0.182	0.04	0.03	8.8	3.9	6
SW01	EPA33	31-Jul-24	6.7	12.1	388	61	3.3	82	12	10	41	2	7.73	1.18	0.27	0.08	5.2	6.5	91

Note: * Sampling not completed

3.3 Alluvial Groundwater

As shown in Table 3-4, several parameters monitored within the alluvial groundwater system exceeded the nominated trigger values. These include:

- Ammonia in upslope monitoring bore EPA 04;
- pH in both upslope and downslope monitoring bores EPA 04 and 05;
- Iron within upslope and downslope monitoring bores EPA 04 and 05.

Within the upslope bore EPA 04, ammonia concentrations exceeded the predefined water quality trigger value of 1.43mg/L in only November's sampling round with maximum concentration of 3.3 mg/L. Although an elevated concentration was recorded, the median ammonia concentration has fallen below the trigger value for 2024. Ammonia concentrations in EPA 05 (MW05) has remained consistently below the trigger level.

Iron concentrations in Novemeber of EPA 04 and all EPA 05 downslope samples exceeded the trigger value of 1.0mg/L. Figure 3-4 shows an upward trend of elevated iron concentration in samples collected from the downslope monitoring bore EPA 05 since 2012, however median iron concentrations decreased in both sampling locations in 2024.

Overall water quality in the alluvial groundwater system continues to improve. Data presented from the alluvial groundwater management unit between 2003 and 2024 (Appendix A) indicates a general decrease in conductivity, sodium, sulphate, magnesium, chloride and potassium concentrations, with an increase in iron concentration. This is likely associated with the closure of the northern landfill area, integration of enhancements to the onsite stormwater management systems and general site management.

3.3.1 Nature and level of human health and environmental risk

No contaminants have been recorded within any of the alluvial monitoring bores that would pose immediate human health risks.

All pH levels within both monitoring bores EPA 04 and 05 are outside (below) the nominated trigger range. Recorded pH values for the duration of the monitoring program (2023 – 2024) have been consistently lower than the trigger levels. This is possibly caused by naturally acidic groundwater in the broader alluvial aquifer (AWC, 2015).

The highest Ammonia concentration observed in 2024 sampling round was in Novemeber, with concentrations declining in the following months. A review of the four-point median (Figure 3-3) shows a general decrease in ammonia concentration in recent years at EPA 04 and has fallen below the trigger value, while EPA 05 has remained consistently within the trigger value since 2005. Considering the water table at EPA 05 is located downgradient of EPA 04, the water quality of the underlying aquifer migrating offsite complies with the trigger levels suggesting that there is no impact on the receiving envionment. Continued improvement in the operation and management and discontinuation of landfulling of the Myocum Landfill has resulted in reduced environmental risk of the downslope alluvial aquifer.

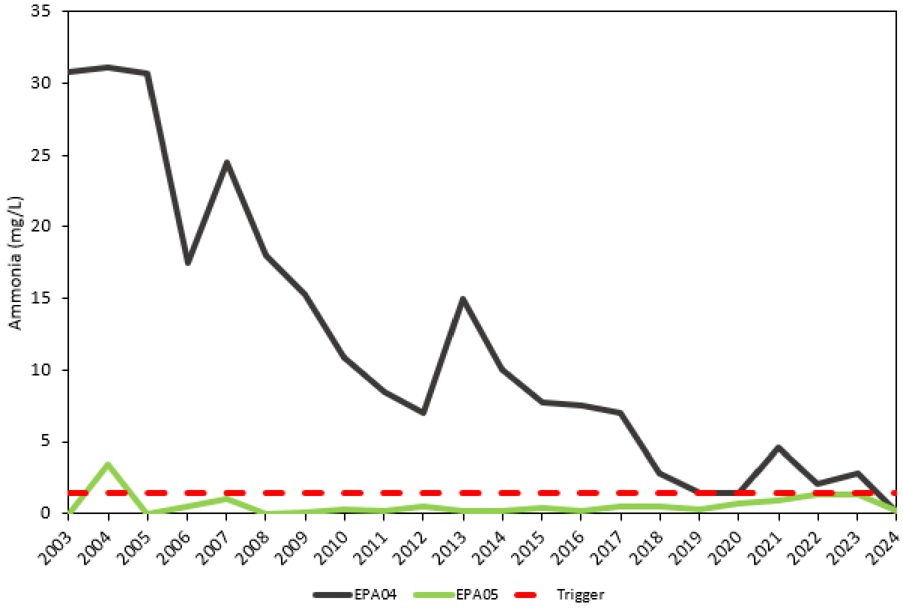

Figure 3-3: Running 4pt Median for Alluvial Groundwater Ammonia values

Although iron concentration in the downstream monitoring bore (EPA 05) regularly exceeds the trigger value, as shown in Figure 3-4, there is a low risk of human health concerns. Iron concentrations have been found to be elevated in many of the other monitoring bores onsite, including upslope regional bores. Refer to Sections 3.4 and 3.5 below. In the 2024 round of monitoring, iron levels at EPA 04 dropped below the trigger value of 1 mg/L and EPA 05 were marginally above however trending lower based on the years previous.

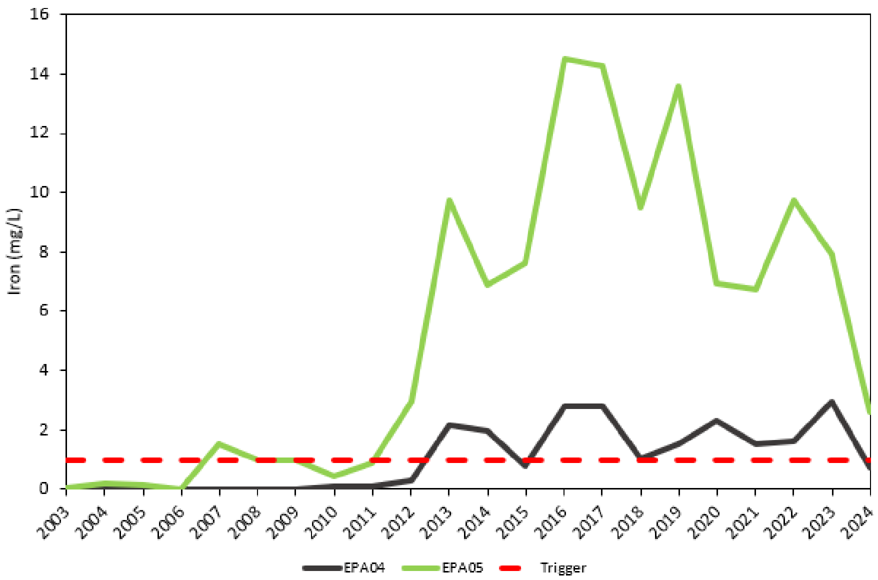

Figure 3-4: Running 4pt Median for Alluvial Groundwater Iron values

3.3.2 Augmenting the current monitoring regime

The current monitoring program employed to assess the potential impacts of the Myocum Landfill on the alluvial aquifer adequately monitors water quality within the aquifers moving in a northerly direction. The sampling regime provides a good temporal scale of data collection, allowing the assessment of the continued reduction of ammonia concentration within monitoring bore EPA 04 and the continued compliance of the localised alluvial aquifer water quality in the downgradient monitoring bore EPA 05.

3.4 Regional Groundwater

3.4.1 Upslope bores – EPA 02 and EPA 23

Two of the five regional groundwater bores can be viewed as 'upslope bores' (Bores EPA 02 and 23) and hence be used to infer whether the operation of the Myocum Landfill is impacting the regional groundwater system. As shown in Table 3-4, upslope monitoring bores EPA 02 and 23 were compliant with most monitoring parameters; the exceptions being nitrate, calcium and potassium (EPA 02 only), manganese (EPA 23 only) and iron (for both EPA 02 and EPA 23):

- All iron concentrations for the regional aquifer upstream monitoring bores during the reporting period exceeded the trigger value of 0.08mg/L.
- One nitrate value from monitoring bore EPA 02 was above the trigger value of 1.87 mg/L; however, all results from monitoring bore EPA 23 were below the trigger value.
- One potassium value from monitoring bore EPA 02 were above the trigger value of 1.0 mg/L; however, all results from monitoring bore EPA 23 were below the trigger value.
- One calcium value from monitoring bore EPA 02 was 0.1 mg/L above the trigger value of 2.0 mg/L; however, all results from monitoring bore EPA 23 were below the trigger value.
- Due to the location of upslope monitoring bores EPA 02 and 23, the aforementioned exceedances are unlikely to be the result of the operation of the landfill. Observed increases in ammonia, nitrate, potassium and iron are possibly the results of other catchments / climatic influences, including upslope domestic onsite wastewater treatment/disposal systems (ammonia and nitrate) and/or dry/wet climatic conditions preceding sampling, resulting in more mobile iron within the soil column (AWC, 2015).

3.4.2 Downslope bores – EPA 01, EPA 03, and EPA 24

The remaining three regional groundwater monitoring bores (EPA 01, 03 and 24) are located downslope of the landfill as shown in Figure 2-3:

- Within the Northern Sediment Dam (EPA 01);
- Within the quarry to the west of the landfill (EPA 03); and
- Just north of the weighbridge (EPA 24).

This network of bores has been located to track potential groundwater contaminants in the regional aquifer to the west and north-west of the site, in a similar direction to the topography of the site.

As shown in Table 3-4, ammonia trigger value of 1.74 mg/L and total organic carbon trigger value of 13.0 mg/L (July monitoring event only) were exceeded in monitoring bore EPA 01; however concentrations at the other two downstream bores complied with the trigger. The chloride values exceeded the trigger value of 118mg/L in monitoring bore EPA 03 only, as did magnesium (excluding February) with trigger value 5.0 mg/L with the addition of the May and July monitoring events of EPA 24. The nitrate trigger value of 1.87mg/L was exceeded in monitoring bore EPA 24 only. The sulphate trigger value of 26 mg/L was exceeded in monitoring bore EPA 01 (excluding July) and February monitoring event at EPA 24.

Manganese exceeded the trigger value of 0.63 mg/L in every monitoring event of this reporting period for all three downstream groundwater monitoring bores with the exception of the February monitoring event for EPA 23 and 24. Iron levels exceeded the trigger value of 0.08 mg/L, calcium exceeded the trigger value of 2.0 mg/L, alkalinity exceeded the trigger value 13.5 mg/L and potassium exceeded the trigger value of 1.0 mg/L in every monitoring event of this reporting period for all three downstream groundwater monitoring bores EPA 01, EPA 03 and EPA 24.

Appendix A shows results for all historical data from the regional groundwater management unit from 2003 to the current reporting period. Calcium, alkalinity and sulphate values markedly increased at the 2008 time period at the EPA 01 and 24 monitoring sites, values have since decreased and have become relatively stable, however they do generally exceed the trigger values assigned. Monitoring site EPA 01 has had elevated levels of calcium, total organic carbon and alkalinity since 2015.

Based on the results above the following parameters were assessed using medians over time, to smooth out spikes/ low and observe longer-term trends. The following parameters were assessed further below;

EPA 01 (MW01)

- Ammonia
- Total Organic Carbon
- Sulphate
- Iron

EPA 24 (MW07)

- Nitrate
- Iron

A selection of running four-point median results from the downslope monitoring bores EPA 01, 03 and 24 are shown in Figure 3-5.

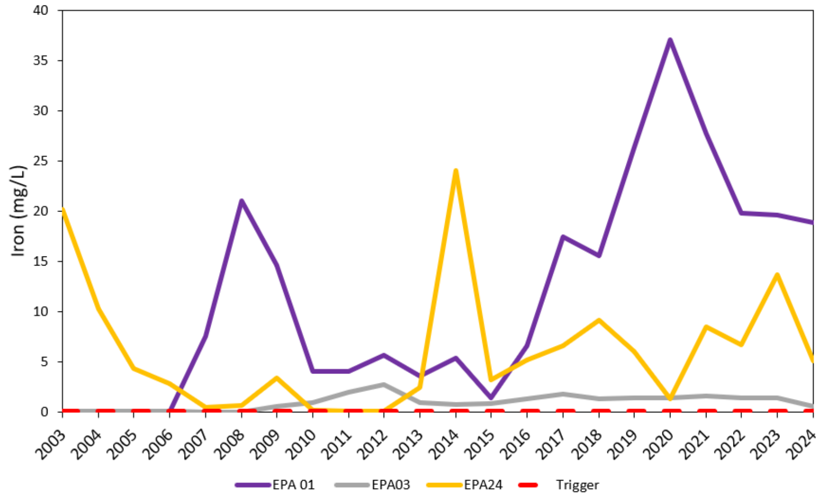

Figure 3-5a: Iron Regional Groundwater Medians

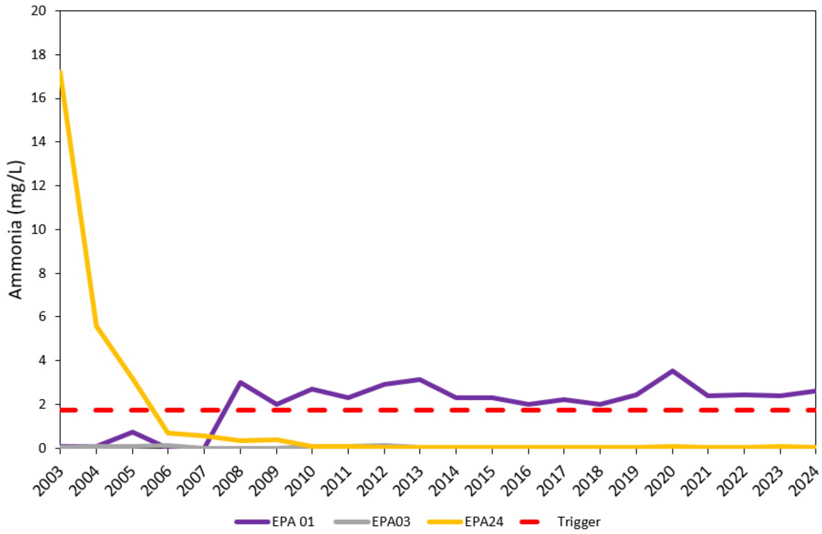

Figure 3-5b: Ammonia Regional Groundwater Medians

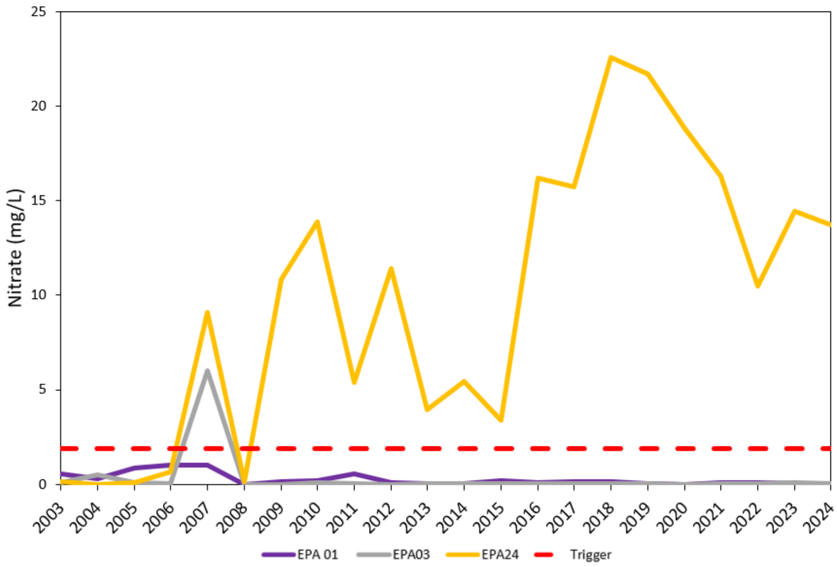

Figure 3-5c: Nitrate Regional Groundwater Medians

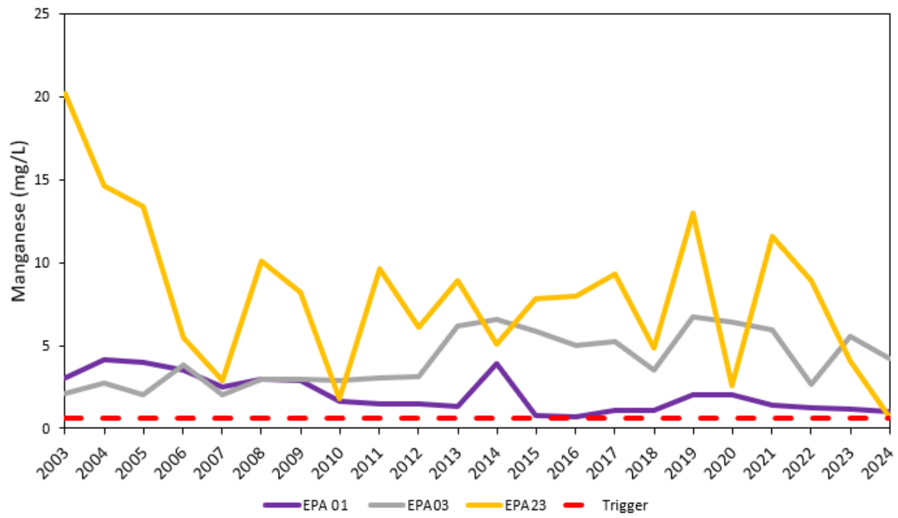

Figure 3-5d: Manganese Regional Groundwater Medians

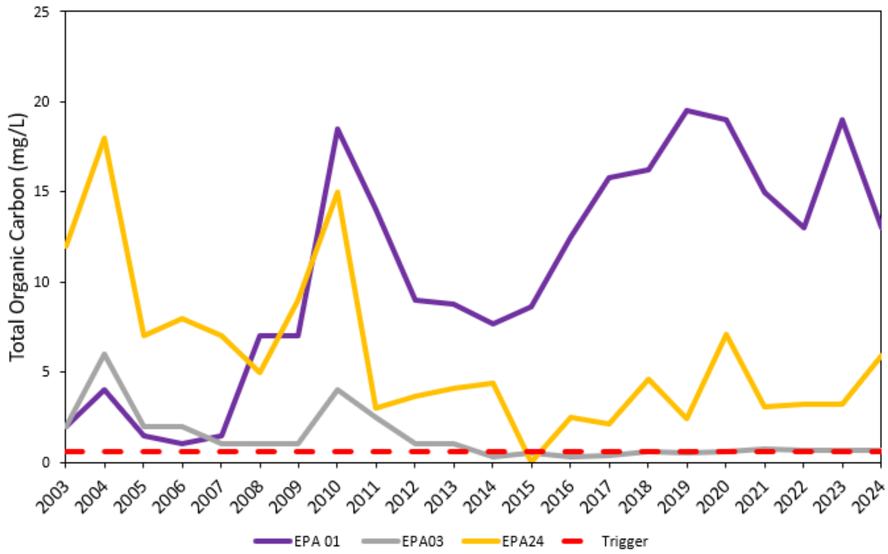

Figure 3-5e: Total Organic Carbon Regional Groundwater Medians

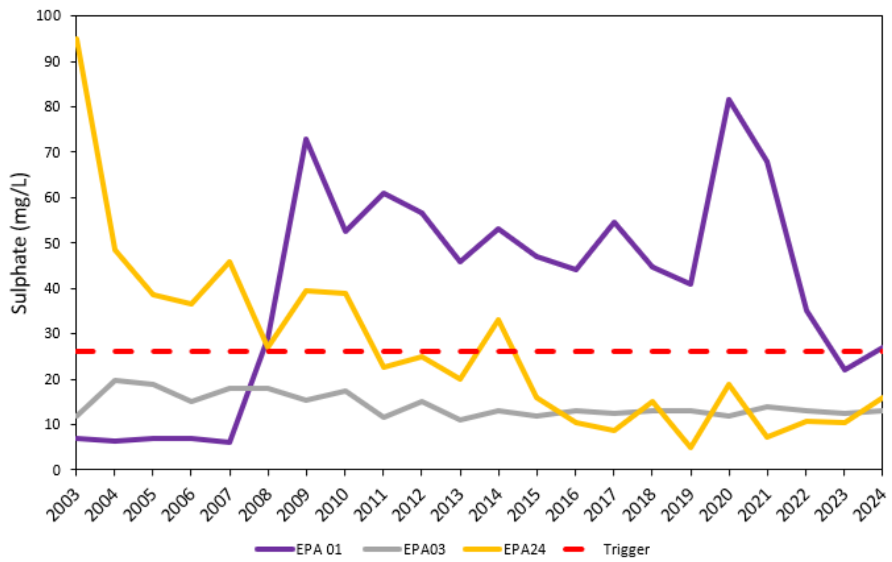

Figure 3-5f: Sulphate Regional Groundwater Medians

As shown in Figure 3-5b, ammonia concentrations within EPA 01 (northern side of landfill) increased significantly in 2007 and thereafter plateaued until 2019 and has remained relatively consistent in recent reporting periods. In reference to the alluvial groundwater sampling bores that are both upslope (EPA 04) and downslope (EPA 05) of this regional monitoring bore (refer to Figure 3-3), ammonia contained within the alluvial groundwater management unit may be entering the deeper regional groundwater management unit, hence resulting in the observed presence of low concentrations of ammonia. As observed with the alluvial monitoring bores, this observed impact likely reduces with distance from the landfill. All ammonia concentrations recorded for EPA 01 during this monitoring period exceeded the trigger value of 1.74mg/L; however, the other two downstream bores' (EPA03 and EPA24) ammonia concentrations complied with the trigger.

3.4.3 Nature and level of environmental risk

No contaminants have been recorded within any of the regional monitoring bores at concentrations that would pose significant human health risks.

Many contaminants within monitoring bores EPA 01, EPA 03 and EPA 24 exceeded their nominated trigger value, and as such pose a potential level of environmental risk. The location of EPA 01 is within the Northern Sediment Basin (upstream of SDP1 – EPA 06), and since 2008 has yielded results vastly different to that collected prior to 2008. As such, water taken from monitoring bore EPA 01 is not viewed as being indicative of the wider regional aquifer. Monitoring results from monitoring wells within the alluvial aquifer at EPA 04 and EPA 05 correlate well with EPA 06 suggesting that there is potential that this bore (EPA 01) is directly influenced by water contained within the Northern Sediment Dam.

Although there is an exceedance of some analytes in the upslope bores, there is a higher degree of exceedance in the downslope bores. This may indicate the landfill site as a contamination source for the regional groundwater aquifer. For example, alkalinity, sulphate, chloride, calcium, potassium and magnesium during the current monitoring period exceed their trigger values in the downslope monitoring bores; however, values are generally compliant in the upslope monitoring bores.

3.4.4 Augmenting the current monitoring regime

The monitoring regime provides a good temporal scale of data collection and a wide variety of analytes associated with assessing both environmental and human health risks. There are, however, some issues with the location of downslope monitoring bores, highlighted in the previous annual reports. The location of monitoring bores EPA 01 and EPA 03 may yield results that may inadequately describe the quality of the regional aquifer. These results need to be investigated further.

Council has liaised with the EPA concerning decommissioning monitoring bore EPA 01 and installing another downslope regional monitoring bore north of the Northern Sediment Basin. Council will continue to liaise with the EPA regarding this, however, both parties need to be cognisant of any unintended impacts on any inconsistency that may arise when analysing new well data with historic data sets.

EPA 03 has been yielding consistent results since 2003. Due to its location within the quarry and low depth to groundwater it represents localised hydraulic and quality impacts rather than regional impacts. These localised impacts are strongly influenced by quarry activities. High chloride and magnesium levels which are not typically found in the deeper upstream bore (EPA 24) are associated with these localised influences. It's position does not represent the impacts the landfill has on the deeper regional aquifer downslope; however, it still provides information on potential impacts the landfill may have on the local shallow groundwater aquifer.

3.5 Surface Water

Surface water sampling sites are located at the spillway of both sediment dams, and within the Simpson Creek Tributary, 1 km west of the landfill site. It is important to note that results presented from sites EPA 06 (Surface Water Discharge Point 1 - SDP1) and EPA 08 (SDP2) do not represent waters discharging to the receiving environment, as samples are taken from water within the sediment basins (at the spillway end), not from water overtopping the spillway. Table 3-4 shows recorded values for the current monitoring period and Appendix A shows graphs containing the collated historical water quality values.

During the 2023-24 monitoring period, all calcium values recorded from monitoring sites EPA 06 (SDP1) and EPA 08 (SDP2) exceeded the trigger value of 20.7 mg/L. All ammonia levels at EPA 06 have decreased slightly from the previous monitoring round, with all sampling rounds falling below the trigger value of 0.36 mg/L. All potassium levels for EPA 08 exceeded the trigger level of 11.8 mg/L. Iron exceeded the trigger value of 1 mg/L in all monitoring events at monitoring site EPA 33 and in November and July sampling round at EPA 06. Additionally, several isolated trigger exceedances occurred with other analytes, namely:

- Three of the four alkalinity values at EPA 08 (Figure 3-6a);
- Two exceedances for pH with trigger value 6.5 - 9.0 at EPA 33 and one at EPA 08; and
- A single exceedance of total organic carbons for EPA 06.

The furthest downstream background surface water monitoring site in the Simpsons Creek tributary (SW1 - EPA 33) continually exceeded iron water quality triggers and pH criteria on two occasions, which is unlikely to be caused by landfill operations. Dissolved Oxygen levels were below the trigger value of 6 mg/L for all EPA 33 sampling events (excluding July sampling), and above for all other events at EPA 06 and 08 (excluding EPA 06 November sampling). DO is a highly variable water quality parameter with concentrations constantly affected by complex biological and physical influencing environmental factors (e.g., diffusion and aeration, photosynthesis, respiration and decomposition, seasonal temperature, the amount of naturally occurring organic matter, salinity, algal presence, and the time of day the sample was taken). Although the monitoring point EPA 33 is required to have samples taken and results compared with the relevant trigger values, the licence identifies the monitoring point as a background surface water monitoring point. The licence may require updating to reflect site conditions.

Iron is observed at elevated levels naturally within the region and is highly mobile within the soil and groundwater environment. During low rainfall conditions, it is probable that the concentration of iron within the surface and shallow groundwater system increases due to lack of dilution from rainfall and enhanced oxidation and mobilisation of iron-bound clay particles within the wider soil profiles surrounding monitoring point EPA 33 (AWC, 2015). Median values for iron recorded at EPA 33 have steadily increased since 2011, with an increase in 2015 and 2019 and decrease in more recent events for EPA 33 as shown in Figure 3-6e.

Since environmental monitoring commenced at Myocum Landfill, water quality within monitoring sites EPA 06 and EPA 08 has consistently exceeded trigger values for potassium and calcium as shown in Figures 3-6b and 3-6c respectively, however EPA 06 fell below the potassium trigger value of 11.8 mg/L for all four sampling events.

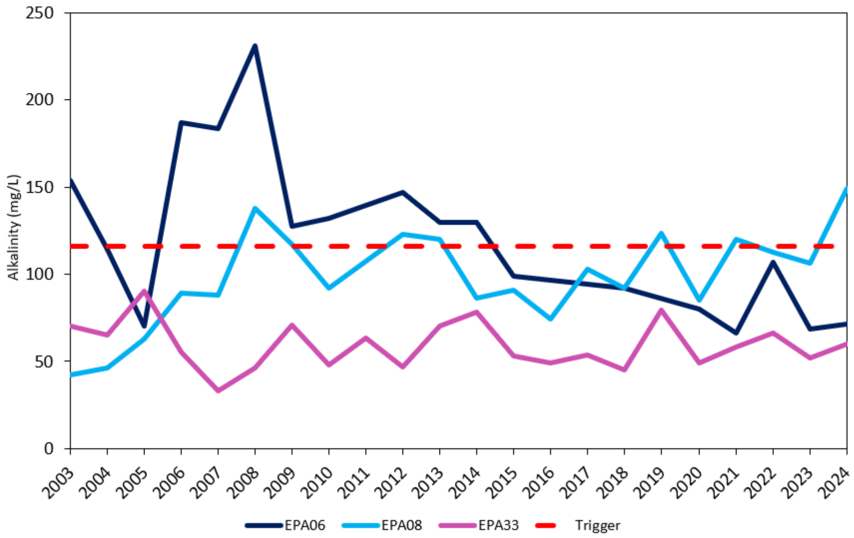

Figure 3-6a: Alkalinity Surface Water Medians

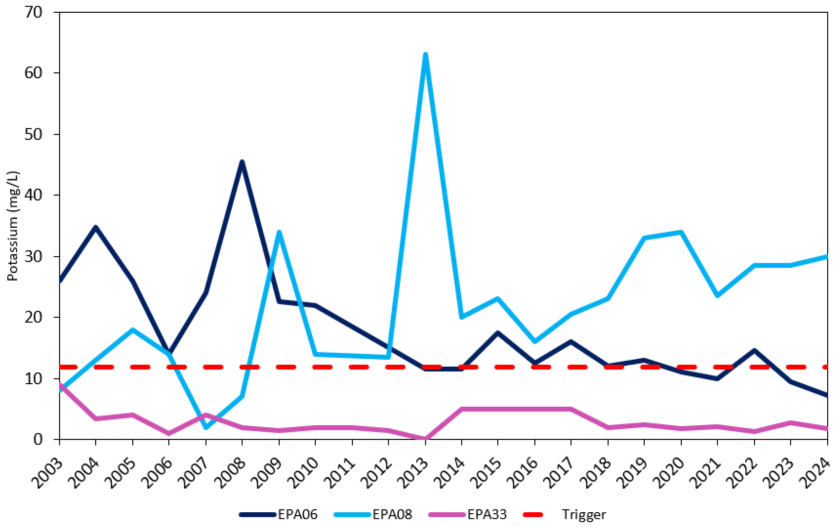

Figure 3-6b: Potassium Surface Water Medians

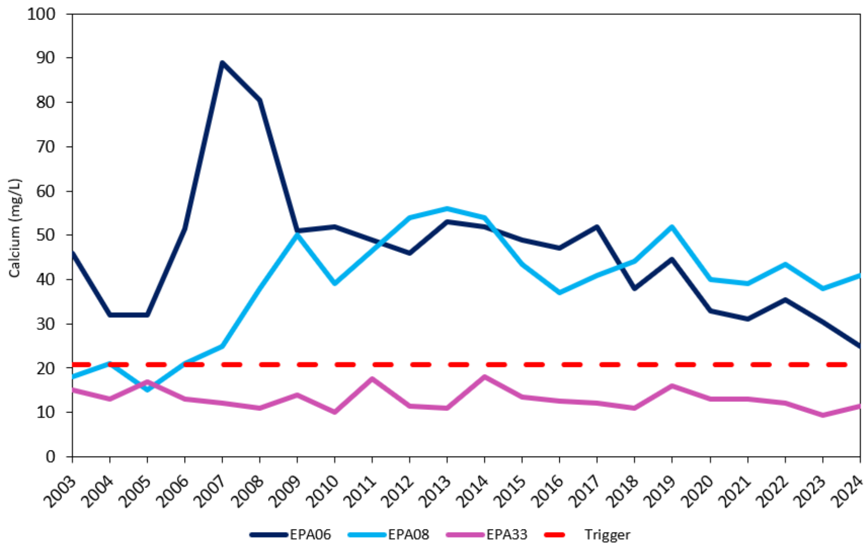

Figure 3-6c: Calcium Surface Water Medians

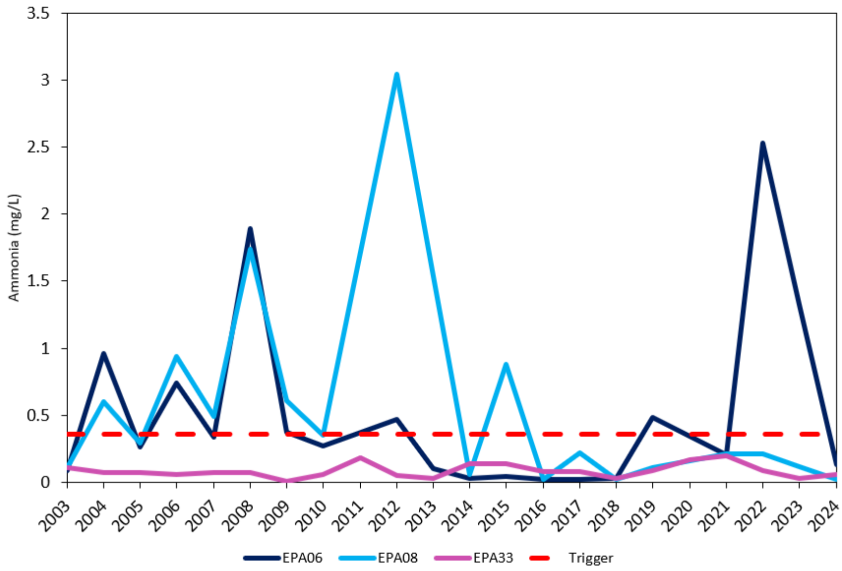

Figure 3-6d: Ammonia Surface Water Medians

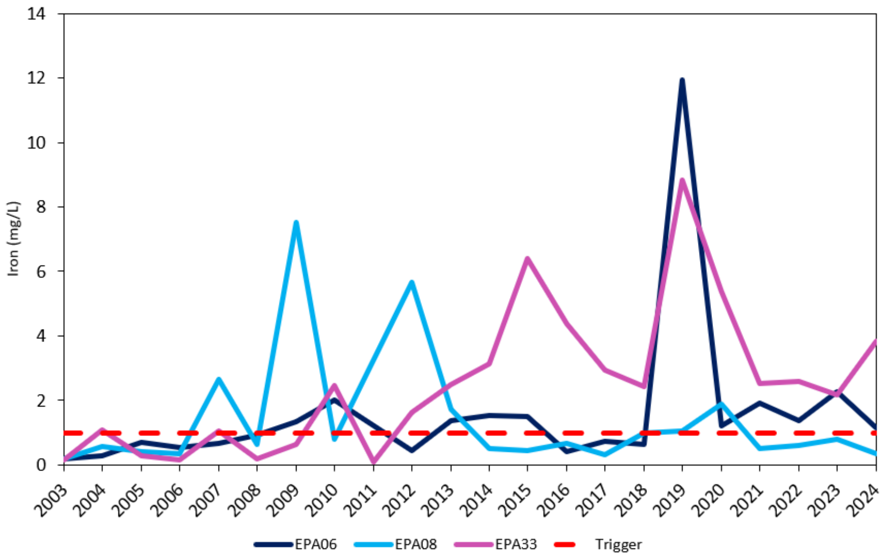

Figure 3-6e: Iron Surface Water Medians

3.5.1 Nature and level of environmental risk

No contaminants have been recorded at any of the surface water monitoring locations that would pose significant human health risks and are generally deemed low risk.

Numerous contaminants within monitoring points EPA 06 and 08 exceeded their nominated trigger values (pH, alkalinity, potassium, calcium, ammonia and iron); however, these contaminants are mostly restricted to salts, which pose minor concern for the environment at the concentrations observed.

It is important to reiterate that the data reported for monitoring points EPA 06 and EPA 08 is collected from within the ponds, rather than stormwater exiting the ponds during wet weather events. As such, high salt concentrations of the water are expected at certain times of the year, based on rainfall and evaporation patterns diluting or concentrating salts within the water column of the sediment ponds. All yearly medians for EPA 06, 08 and 33 fell below the trigger value.

3.5.2 Augmenting the current monitoring regime

The current monitoring program employed to assess the potential impacts of the Myocum Landfill on the surface water adequately monitors water quality. The sampling regime provides a good temporal scale of data collection.

4. Conclusion

Presented in this report is recent ground and surface water data collected during the monitoring period between September 2023 and August 2024, along with all historical data collected since 2003. Water quality within both the alluvial and regional groundwater management units were presented, along with surface water in the site sediment dams and one off-stream permanent creek system (Simpsons Creek).

4.1 Alluvial Groundwater

Groundwater data collected from the alluvial aquifer indicate historical landfilling activities are impacting water quality. Ammonia concentration in monitoring point EPA 04 routinely exceeds the trigger value in the past, however in 2024 sampling rounds the median fell below the trigger value. This contamination is, however, not apparent in the downslope monitoring point EPA05, indicating rapid attenuation within the alluvial aquifer system. This environmental impact has improved considerably since 2003, with compliant results likely to be achieved in the coming years, based on the trajectory of the monitoring data.

No contaminants have been recorded within any of the alluvial monitoring bores that would pose human health risks.

No augmentation is recommended for assessing the potential impacts of the Myocum Landfill on the alluvial aquifer.

4.2 Regional Groundwater

Monitoring points EPA 02 and 23 represent upslope monitoring points that provide a good reference point to review the potential impact of the landfill on the regional groundwater aquifer. The regional aquifer downslope of the landfill has an elevated range of contaminants compared with the upslope aquifer, mainly restricted to salts.

EPA 01 is located within the Northern Sediment Basin and has directly impacted localised water quality due to migration down well string indicating the landfill may be a contamination source for the regional aquifer. Similarly, the location of EPA 03 within the quarry and low depth to groundwater represents localised hydraulic and quality impacts rather than regional impacts.

Council will continue to sample and monitor EPA 01 and EPA 03 and will continue to liaise with the EPA regarding the installation of a new regional aquifer bore in place of EPA 01 north of the Northern Sediment Dam. No contaminants have been recorded within any of the regional monitoring bores that would pose human health risks.

4.3 Surface Water

Sampling results from monitoring sites EPA 06 and 08 presented in this report represent water within the respective sediment basins, rather than the actual flow of water entering the receiving environment. Numerous salts within the sediment basins exceed their nominated trigger values; however, the risk to the environment is considered low due to the presumed dilution of these salts with the increased stormwater flow that occurs in a discharge event.

No contaminants have been recorded that would pose human health risks within any of the surface water monitoring sites.

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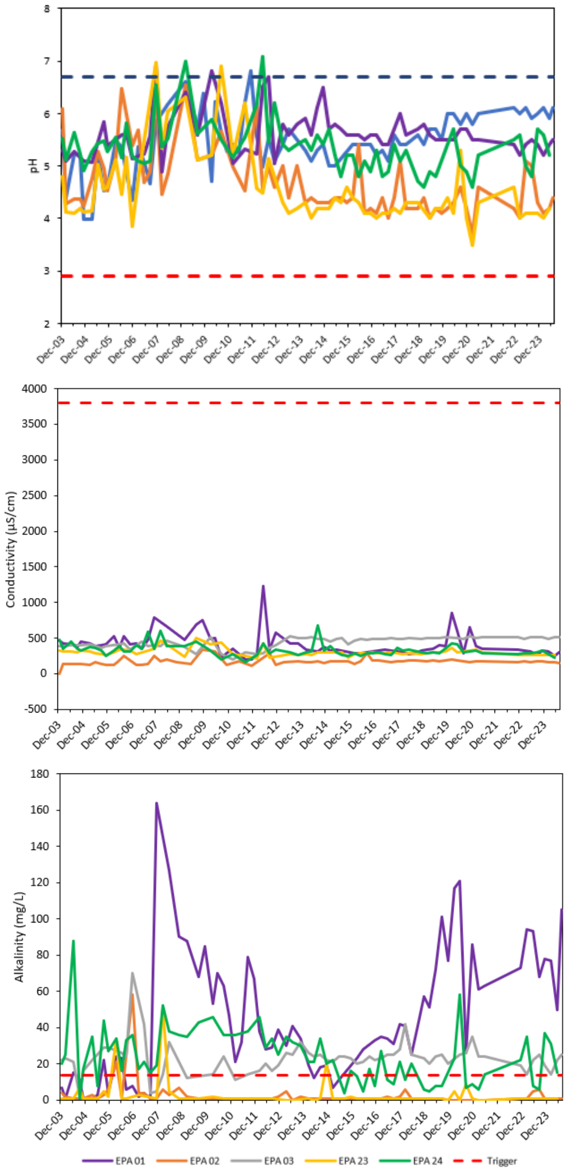
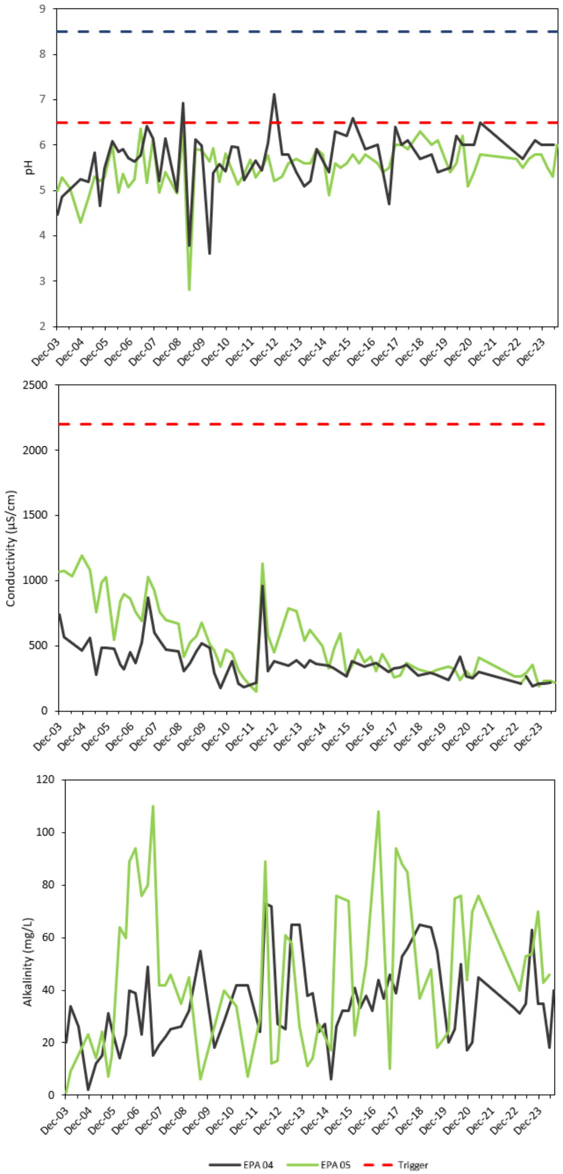
Appendix A

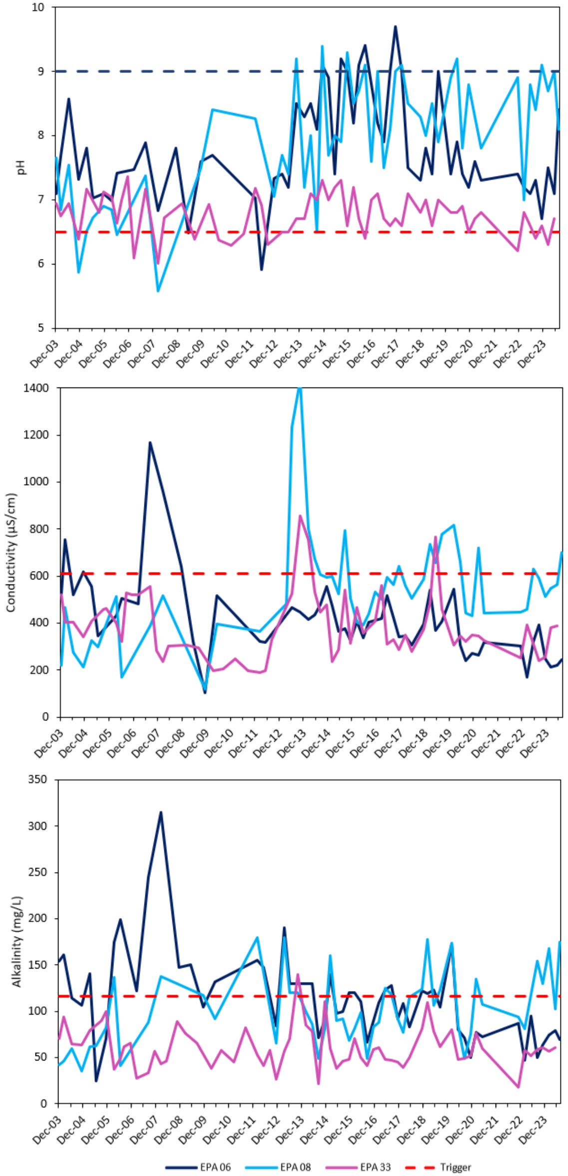
Regional Groundwater



Alluvial Groundwater



Surface Water



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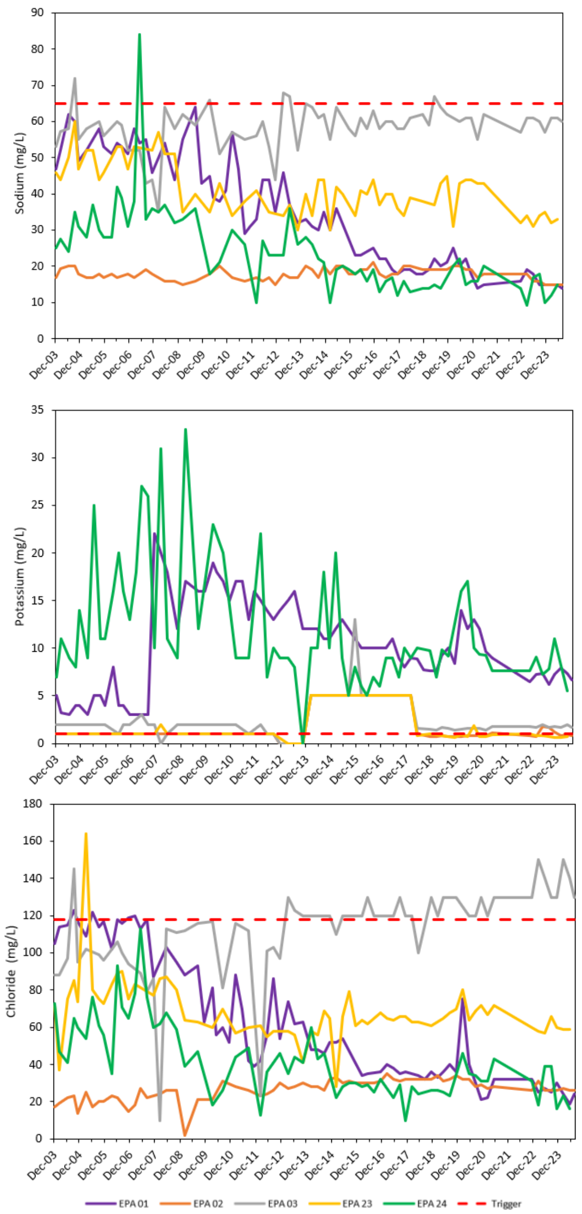
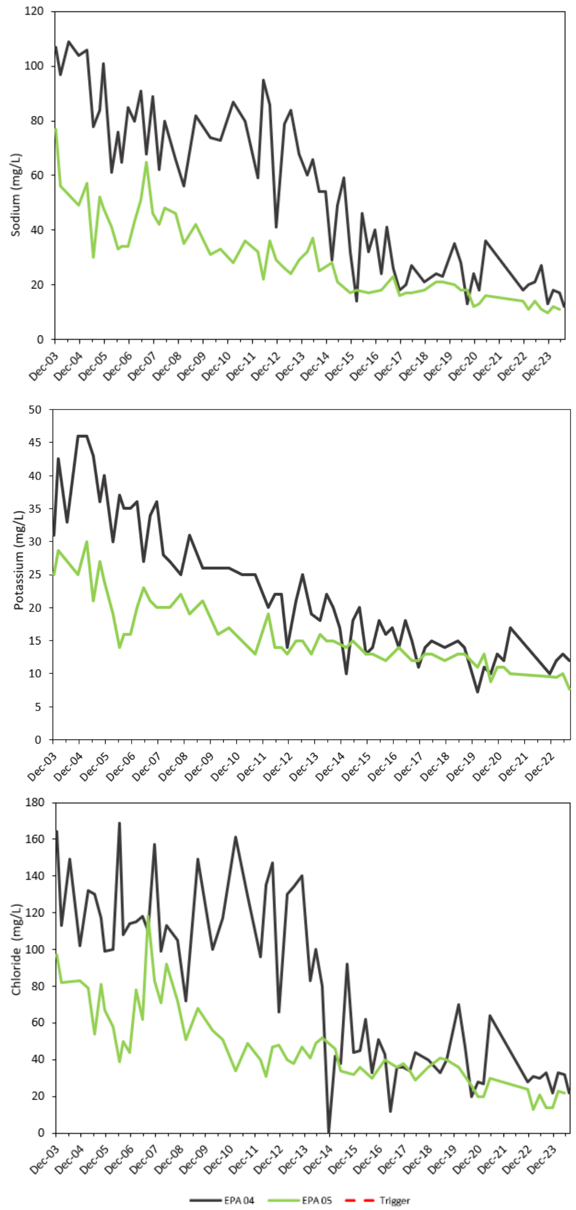
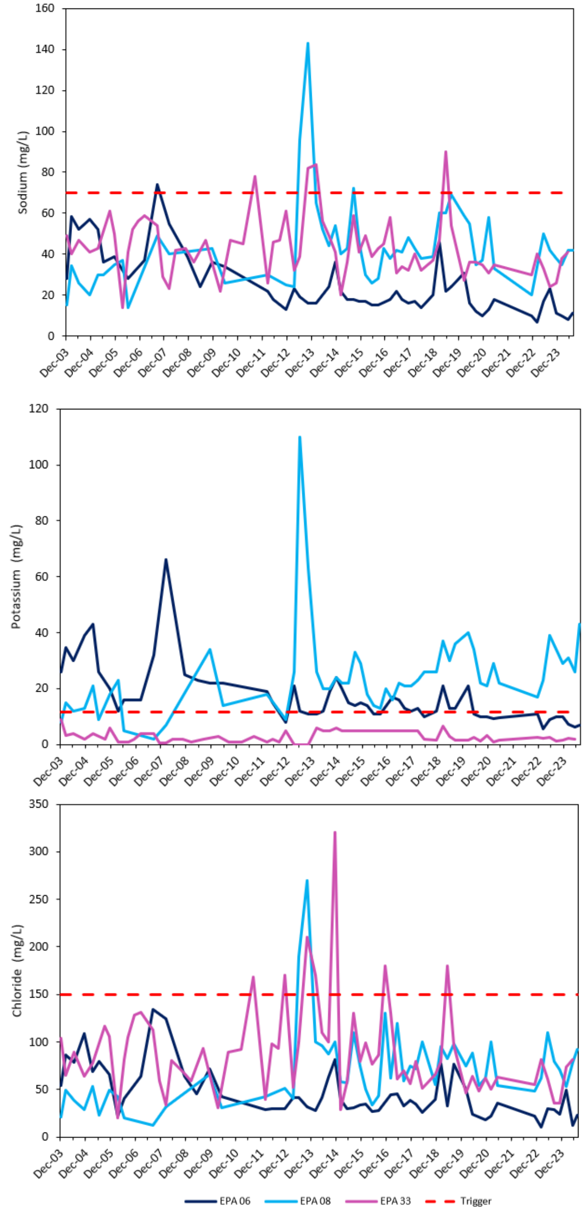


Alluvial Groundwater



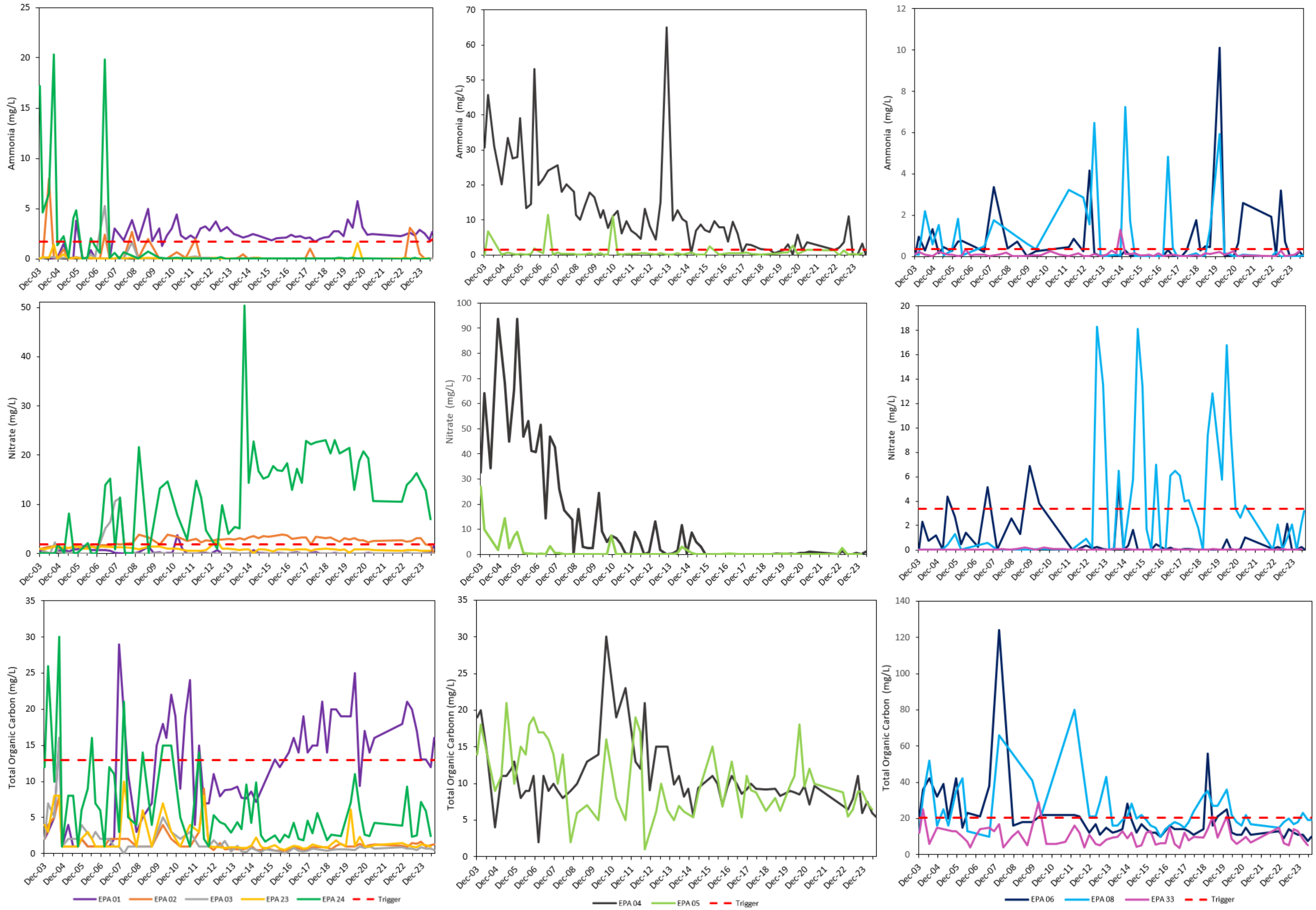
Surface Water



Regional Groundwater

Alluvial Groundwater

Surface Water



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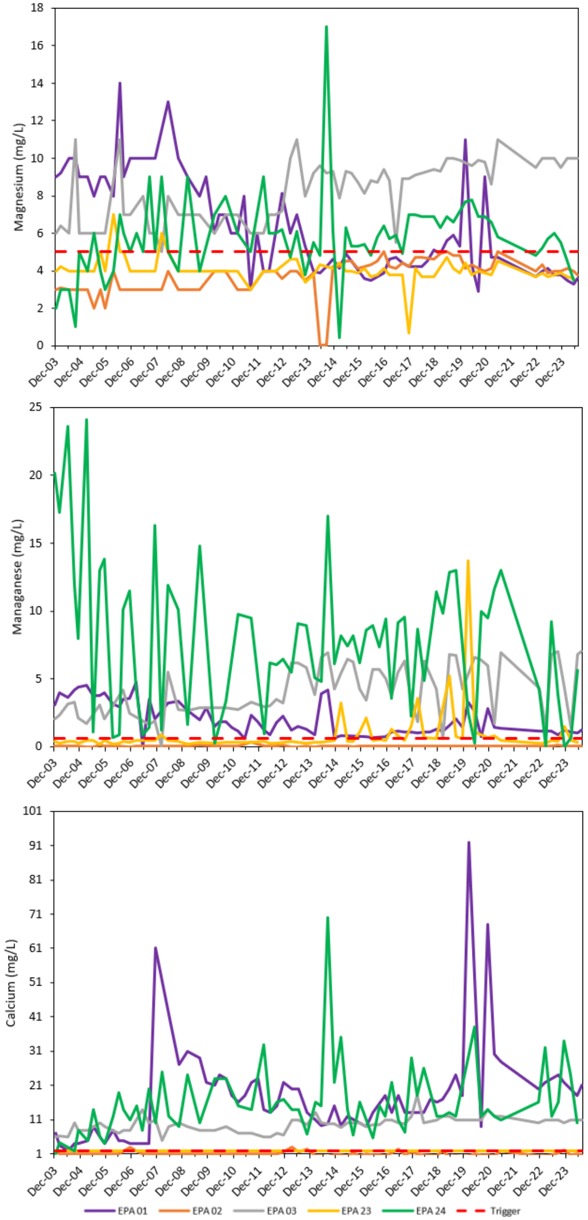
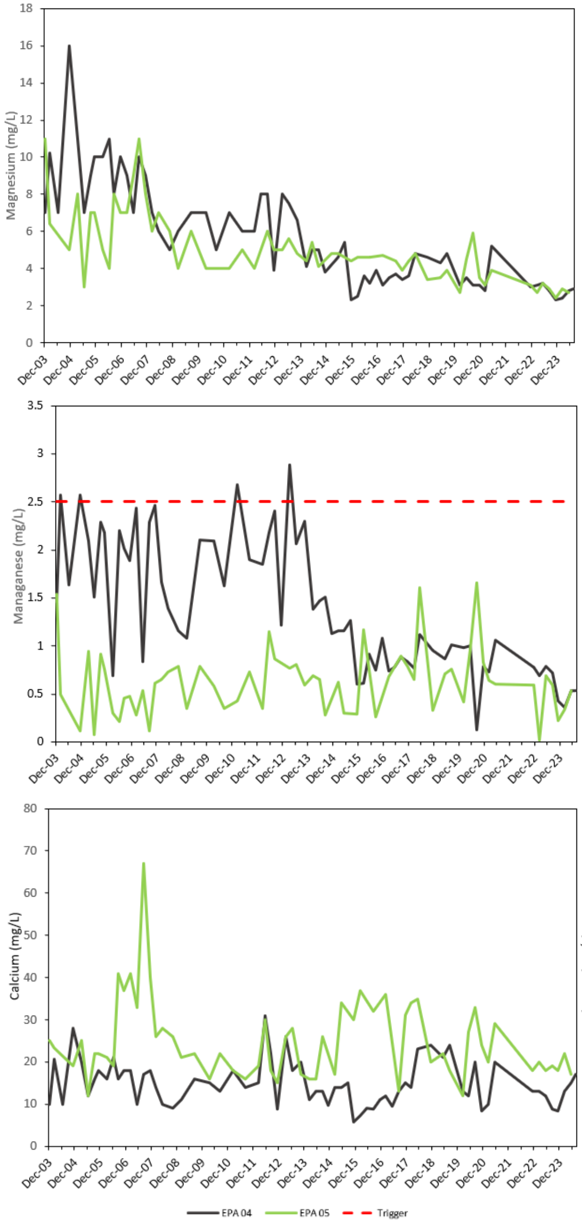
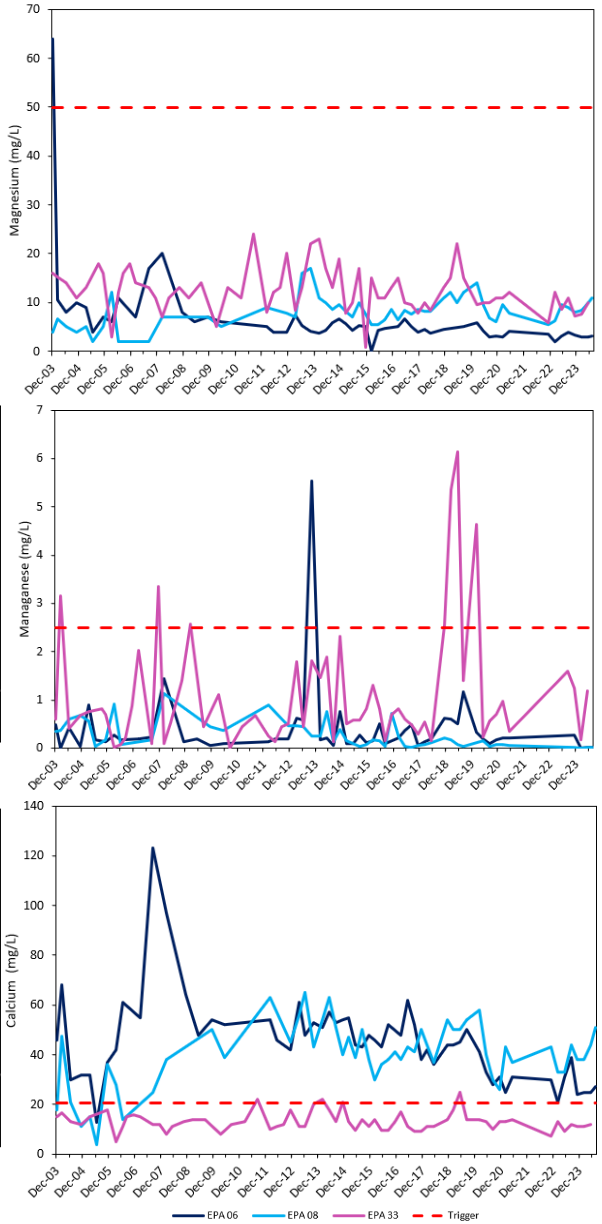


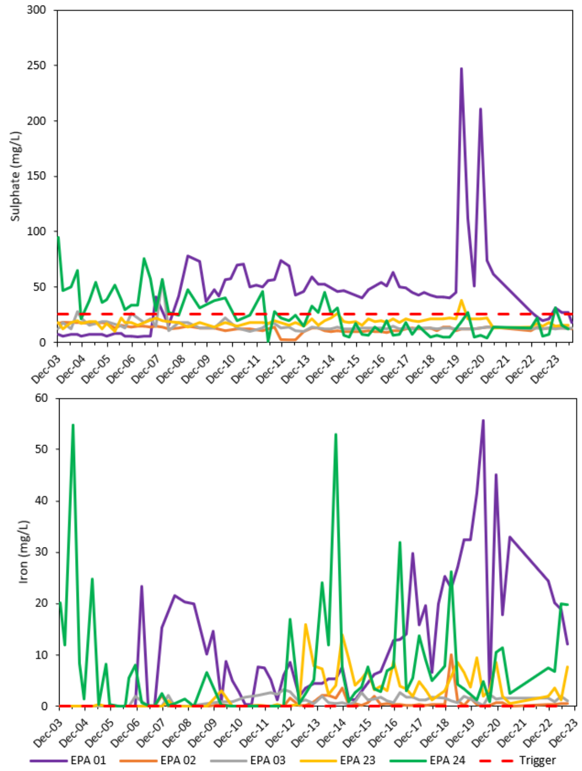
Alluvial Groundwater



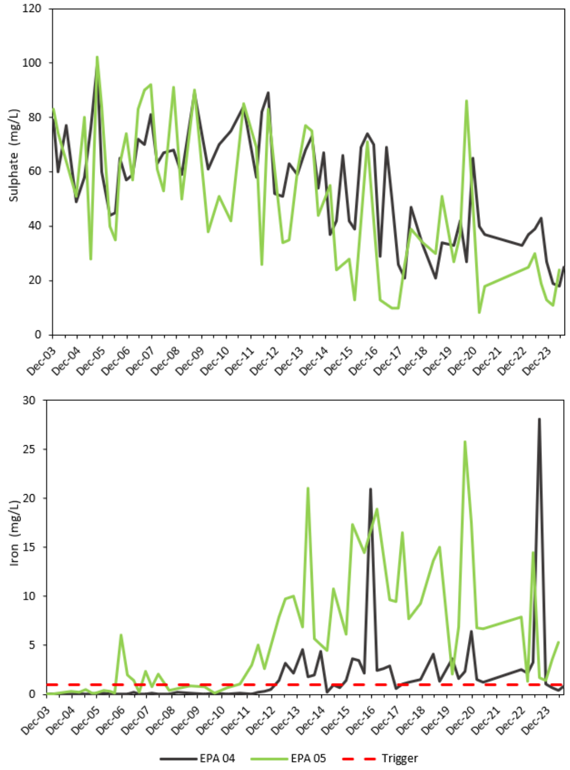
Surface Water



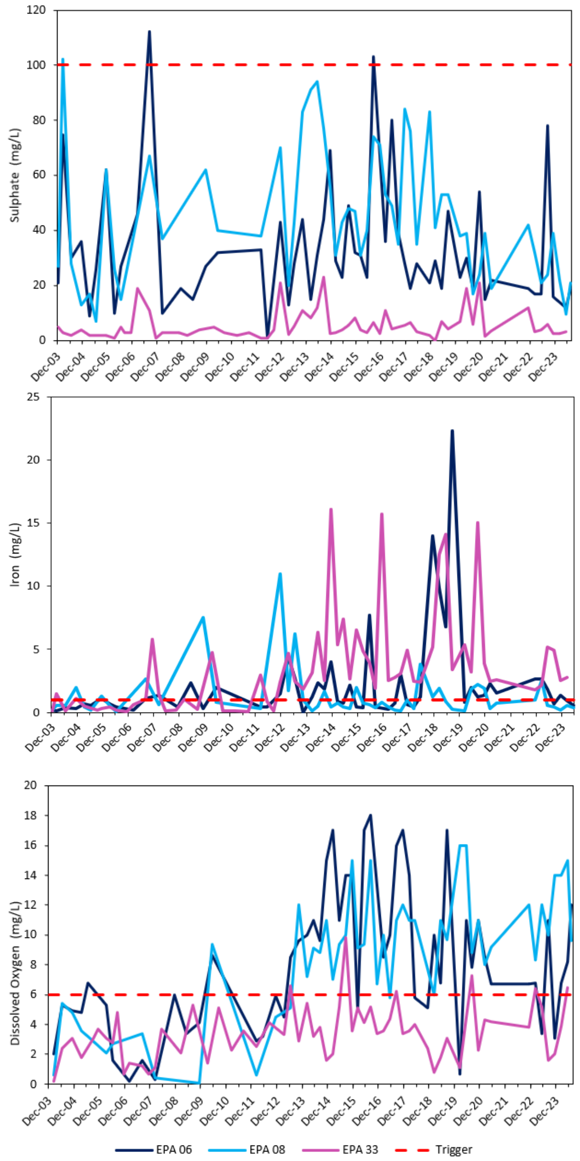
Regional Groundwater



Alluvial Groundwater

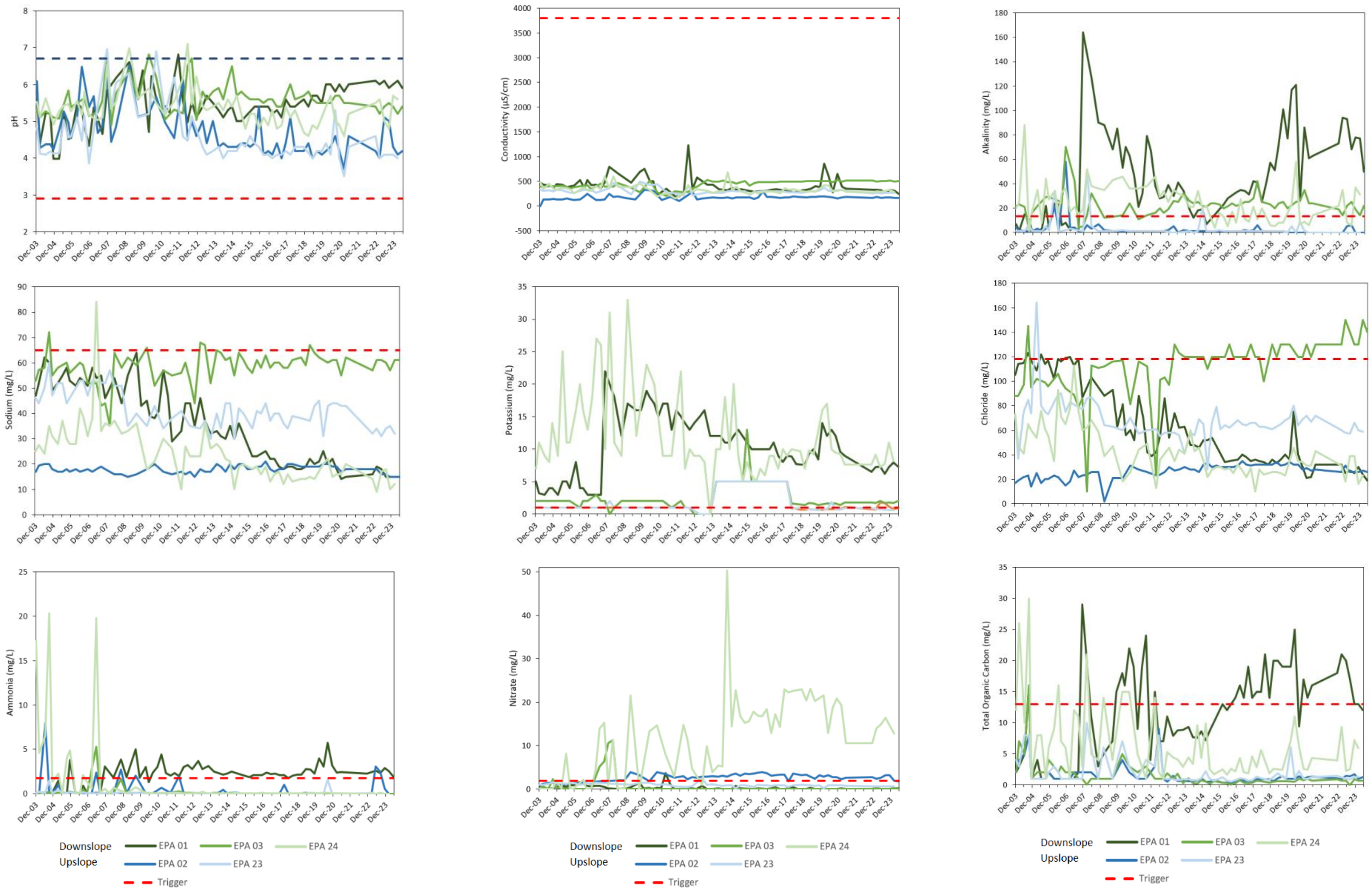


Surface Water



Appendix B

Upslope vs downslope Regional Groundwater Monitoring Results between 2003 and 2024



Upslope vs downslope Regional Groundwater Monitoring Results between 2003 and 2024